Air Resources Board

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Peter M. Rooney
Secretary for Environmental Protection

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Governor

MEMORANDUM

TO: Douglas Y. Okumura, Chief
Environmental Monitoring and Pest Management Branch
Department of Pesticide Regulation

FROM: George Lew, Chief
Engineering and Laboratory Branch
Monitoring and Laboratory Division

DATE: May 4, 1998

SUBJECT: FINAL REPORT FOR THE ENDOSULFAN MONITORING IN FRESNO AND SAN JOAQUIN COUNTIES

Attached is the final report, "Report for the Air Monitoring of Endosulfan in Fresno County (Ambient) and San Joaquin County (Application)." This report contains revisions suggested by your staff which were provided in your March 30, 1998 memorandum.

These results are intended for identifying the presence of endosulfan in ambient air. Additional air monitoring near the use of endosulfan may be necessary to determine if there is a need for mitigation.

If you or your staff have questions or need further information, please contact me at (916) 263-1630 or Mr. Kevin Mongar at (916) 263-2063.

Attachment and Appendices

cc: Ray Menebroker, SSD w/Attachment and Appendices
Cosmo C. Insalaco, Fresno County Agricultural Commissioner w/Attachment
Scott T. Hudson, San Joaquin County Agricultural Commissioner w/Attachment
David L. Crow, SJVUAPCD w/Attachment

Sharon Seidel, OEHHA w/Attachment
John Tecklenburg, Tecklenburg Ranch w/Attachment
Roger Sava, DPR w/Attachment and Appendices

State of California
California Environmental Protection Agency
AIR RESOURCES BOARD

Report for the Air Monitoring of Endosulfan In Fresno County (Ambient) and in San Joaquin County (Application)

Engineering and Laboratory Branch

Monitoring and Laboratory Division

Project No. C96-034

Date: April 17, 1998

APPROVED:

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George Lew, Chief
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Summary

**Report for the Air Monitoring
of Endosulfan
In Fresno County (Ambient) and in
San Joaquin County (Application)**

This report presents the results of application (San Joaquin County) and ambient (Fresno County) air monitoring for endosulfan. Application monitoring was conducted in April, 1997 and ambient monitoring in July-August, 1996. Application monitoring was associated with the use of endosulfan as an insecticide on an apple orchard. Ambient monitoring was conducted to coincide with the use of endosulfan on cotton and grapes. Analysis was performed for two isomers of endosulfan as well as endosulfan sulfate. The results of the application and ambient monitoring are listed in Tables 4 and 7 respectively. Summaries of application and ambient sample results are reported in Tables 5 and 8 respectively. Application sample results are also summarized as associated with each sampling period "wind rose" in Figure 3. Sample results equal to or greater than the limit of quantitation (LOQ) are reported in units of ng/m^3 and pptv to 2 significant figures. Results below the LOQ but equal to or above the limit of detection (LOD) are reported as "detected". Endosulfan sulfate results have not been included in the Tables. Endosulfan sulfate was "detected" in seven of the application samples and was not detected in any ambient samples.

Analyses for the application samples were performed by the California Department of Food and Agriculture's (CDFA) Worker Health and Safety Laboratory. The analytical LODs for endosulfan I and II were 3.0 ng and 6.0 ng per sample respectively. The analytical LOQs for endosulfan I and II were 10 ng and 19 ng per sample respectively. The method LOD and LOQ, expressed in units of ng/m^3 (pptv), are dependent on the volume of air sampled, which varies from sample to sample. The method LODs for an 8-hour sampling period at 2.0 Lpm would be 3.1 ng/m^3 (0.16 pptv) and 6.2 ng/m^3 (0.33 pptv) for endosulfan I and II respectively. The method LOQs for an 8-hour sampling period at 2.0 Lpm would be 10 ng/m^3 (0.53 pptv) and 20 ng/m^3 (1.1 pptv) for endosulfan I and II respectively. Results of the four application background samples were found to be below the LOD for both endosulfan I and II. Results for thirty-four of the thirty-five application samples were above the LOQ for endosulfan I and twenty of the thirty-five application samples were above the LOQ for endosulfan II. The highest endosulfan I concentration, 3800 ng/m^3 (200 pptv), was observed at the east sampling site during the third sampling period (4 hour). The highest endosulfan II concentration, 200 ng/m^3 (11 pptv), was also observed at the east sampling site during the third sampling period (4 hour). Endosulfan sulfate was not found above the LOQ of 19 ng/sample in any of the application samples.

Analyses for the ambient samples were performed by the ARB Testing Section laboratory. The LODs for endosulfan I and II were 3.3 ng and 11 ng per sample respectively. The LOQs for endosulfan I and II were 11 ng and 36 ng per sample respectively. The method LOD and LOQ, expressed in units of ng/m^3 (pptv), are dependent on the volume of air

sampled, which varies from sample to sample. The method LODs for a 24-hour sampling period at 2.0 Lpm would be 1.1 ng/m^3 (0.058 pptv) and 3.8 ng/m^3 (0.20 pptv) for endosulfan I and II respectively. The method LOQs for a 24-hour sampling period at 2.0 Lpm would be 3.8 ng/m^3 (0.20 pptv) and 12 ng/m^3 (0.64 pptv) for endosulfan I and II respectively. None of the nineteen samples collected at the urban background (ARB) site had endosulfan I or II results above the LOQ. Two of the background site samples had "detected" results for endosulfan I (none for endosulfan II). For endosulfan I, of the seventy-five ambient samples taken (spikes, blanks, collocated, "not reported" and background site samples excluded), sixty-six (88%) were found to be above the LOQ, nine (12%) were found to be "detected" and none (0%) were found to be below the LOD.

For endosulfan II, two (3%) of the seventy-five samples were above the LOQ, twenty-nine (39%) were found to be "detected" and forty-four (59%) were found to be below the LOD. The highest values observed for the study were 140 ng/m^3 (7.4 pptv) and 26 ng/m^3 (1.4 pptv) for endosulfan I and II respectively at the San Joaquin Elementary School on August 8, 1996. Endosulfan sulfate was not found above the LOQ of 37 ng/sample in any of the ambient samples.

Acknowledgments

Bud Thoma, LaJuan Taylor and Neil Adler were Instrument Technicians who collected ambient and application samples. Assistance was provided by the Quality Management and Operations Support Branch (QMOSB) of the ARB. Assistance was provided by Doug Edwards of the Fresno County Agricultural Commissioner's Office and Gary Stockel of the San Joaquin County Agricultural Commissioner's Office. Chemical analyses were performed by the Testing Section Laboratory (ambient samples) and by the California Department of Food and Agriculture's Worker Health and Safety Laboratory (application samples).

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of Endosulfan
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I. Introduction

At the request (March 20, 1996 Memorandum, Sanders to Lew) of the California Department of Pesticide Regulation (DPR), the Air Resources Board (ARB) staff determined airborne concentrations of the pesticide endosulfan over a five week ambient monitoring program in populated areas of Fresno County and over a 72 hour application monitoring program in San Joaquin County. This monitoring was done to fulfill the requirements of AB 1807/3219 (Food and Agricultural Code, Division 7, Chapter 3, Article 1.5) which requires the ARB "to document the level of airborne emissions .... of pesticides which may be determined to pose a present or potential hazard..." when requested by the DPR.

The sampling protocol for the ambient monitoring is enclosed as Appendix I in the separate volume of appendices to this report. The method development results and sampling/analysis Standard Operating Procedures (SOP) are also enclosed in Appendix I.

The California Department of Food and Agriculture, Center for Analytical Chemistry (CDFA CAC) report, "Air Sample Analysis Report for Endosulfan Application", is enclosed as Appendix II in the separate volume of appendices to this report.

The ARB Quality Management and Operations Support Branch (QMOSB) report, "System Audit Report Ambient Monitoring of Endosulfan in Fresno County", is enclosed as Appendix III in the separate volume of appendices to this report.

II. Chemical Properties of Endosulfan

The following information regarding the chemical properties of endosulfan was obtained from the DPR's March 20, 1996 "Monitoring Recommendation for Endosulfan" (appendices pg. 87).

The technical grades of endosulfan are mixtures of two stereoisomers α-Endosulfan (64-67%) and β-endosulfan (32-29%) with approximately 4% other material. α-Endosulfan [(3α,5aβ,6α,9α,9aβ)-6,7,8,9,10,10-Hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzo-dioxathiepin-3-oxide] (CAS:959-98-8) and β-endosulfan [3α,5aα,6β,9β,9aα)-6,7,8,9,10,10-Hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzo-dioxathiepin-3-oxide] (CAS: 33213-65-9) are colorless to brown crystals emitting a sulfur dioxide-like odor. Endosulfan has a molecular formula of $C_9H_6Cl_6O_3S$, a formula weight of 460.92 g/mole and a specific density of 1.745 at 20°C. Endosulfan has a vapor pressure of 10^{-5} mmHg at 25°C, but water solubility (S_w), and Henry's Constant (K_H) vary with isomer. α-Endosulfan S_w = 530 ppb at 25°C, K_H = 1.01 x 10^{-4} atm·m^3/mol at 25°C, β-endosulfan

S_w = 280 ppb at 25°C, K_H = 1.91 x 10^{-5} atm·m^3/mol at 25°C. Both isomers are soluble in most organic solvents.

The hydrolysis half-life ($t_{1/2}$) of endosulfan in water (25°C and pH7) is 218 hours for α-endosulfan and 187 hours for β-endosulfan. In plants the $t_{1/2}$ for conversion of α-endosulfan to β-endosulfan is approximately 60 days, and the $t_{1/2}$ for the conversion of β-endosulfan to endosulfan sulfate is 800 days. Each isomer forms its respective sulfate on exposure to light in surface waters.

Degradation of endosulfan in soil yields a mixture of endosulfandiol, endosulfanhydroxy ether, endosulfan lactone and endosulfan sulfate. Endosulfan sulfate is the major biodegradation product in soils under aerobic, anaerobic and flooded conditions. In flooded soils, endosulfandiol and endohydroxy ether were also reported. In sandy loam soil, microorganisms are responsible for degrading endosulfan to endosulfandiol, and further to endosulfan α-hydroxy ether and trace amounts of endosulfan ether. Both products are subsequently converted to endosulfan lactone. This soil transformation pathway is followed by both isomeric forms.

The acute oral LD_{50} of endosulfan for rats in 70 mg/kg (aqueous), and 110 mg/kg in oil. Acute LC_{50} (1-hour) for rats > 21mg/L air. Acute dermal LD_{50} is 500 mg/kg for rats and 369 mg/kg for rabbits. The LC_{50} (96 hour) irrespective of isomer are 0.3 μg/L for rainbow trout, and 3.0 μg/L for white sucker. Endosulfan has entered the risk assessment process at DPR under the SB 950 (Birth Defect Prevention Act of 1984) based on its potential reproductive and neurotoxicity adverse health effects.

As of March 8, 1995, there were 19 active registrations for products containing endosulfan. Eighteen are agricultural products and one is a home-garden product. Formulations of endosulfan include granulars, emulsifiable concentrates and wettable powders. Technical endosulfan is formulated as a dust. The Signal Words on agricultural endosulfan-containing products are "Danger: or "Danger/Poison", and "Warning" on the home garden (9.15% Active Ingredient) product.

III. Sampling

A sketch of the sampling apparatus is shown in Figure 1 of Appendix I (appendices pg. 14). Samples were collected by passing a measured volume of ambient air through XAD-2 resin. The XAD-2 resin tubes were obtained from SKC (#226-30-06). Calibrated rotameters were used to set and measure sample flow rates. The flow rate (2.0 L/minute) was accurately measured and the sampling system operated continuously with the exact operating interval noted. Samplers were leak checked prior to and after each sampling period with the sampling cartridges installed. Any change in the flow rates was recorded in the field log book (see appendices pg. 93). The resin tubes were protected from direct sunlight and supported about 1.5 meters above the ground (or roof) during the sampling period. At the end of each sampling period the tubes were capped and placed in culture tubes with an identification label affixed. The field log book was also used to record start and stop times, sample identifications and any other significant comments. Subsequent to sampling, the

sample tubes were transported on ice, as soon as reasonably possible to the ARB Monitoring and Laboratory Division, Testing Section laboratory for the ambient sample analyses and to the CDFA for application sample analyses. The samples were stored in the freezer or extracted/analyzed immediately.

A. Application Monitoring

The use pattern for endosulfan suggested that application-site monitoring should be conducted during the month of April in San Joaquin County, and that the application be associated with apples or cherries. A three day monitoring period was to be established with intended sampling times as follows: (where the first sample is started at the start of application) application + 1 hour, followed by one 2-hour sample, one 4-hour sample, two 8-hour samples and two 24-hour samples. Information collected included: 1) the elevation of each sampling station with respect to the field, 2) the orientation of the field with respect to North (identified as either true or magnetic), 3) an accurate record of the positions of the monitoring equipment with respect to the field, including the distance each monitor is positioned away from the edge of the field and an accurate drawing of the monitoring site showing the precise location of the monitoring equipment and any wind obstacles with respect to the field, 4) the field size, 5) the application rate, 6) formulation and 7) method and length of application.

An approximately 8.5 acre apple orchard was chosen for the application monitoring site. Refer to Figure 2 for a diagram of the application site. Only approximately 6 acres of the plot were treated during the endosulfan (trade name Thiodan) application. The remaining 1.5 acres was in the northeast corner, as shown in Figure 2, and contained trees just recently planted. Refer to Appendix IV (appendices pg. 86) for a copy of the pesticide control advisor's "Application Site Report". Details regarding the site and application are summarized in Table 1.

Table 1.
Application Information

County/Section/Township/Range:	San Joaquin/18/3N/7E
Product Applied:	Thiodan 50 WP (50% w/w endosulfan A.I.)
Type of Application:	ground-rig blower, 2.5 mph, small nozzle (#3 T-jet), 200psi, 200 mph fan
Application Rate:	3 pounds Thiodan 50 WP/acre in 100 gall. water
Applicator:	John Tecklenburg, Tecklenburg Ranch, Lodi, CA.

Background samples were collected from 1700 April 7 to 0530 April 8, 1997 at the site of the application test. The application was started at 0545 on April 8, 1997 and finished at

0745. Referring to Figure 2, the application started at the north-west corner of the plot with the rows oriented east/west. Table 2 lists the actual sampling intervals.

Table 2.
Application Sampling Periods

Sampling Period		Date	Time
1	application plus 1 hour	4/8/97	0530 to 0845
2	1.9 hour	4/8/97	0845 to 1040
3	4.0 hour	4/8/97	1040 to 1440
4	8.1 hour	4/8/97	1440 to 2245
5	9.5 hour	4/8-9/96	2245 to 0815
6	23.75 hour	4/9-10/96	0815 to 0800
7	24 hour	4/10-11/96	0800 to 0800

Referring to Figure 2, four samplers were positioned, one on each side of the field. A fifth sampler was collocated at the south position. The west (W), east (E) and south (S) samplers were positioned approximately 11 yards, 7 yards and 9 yards from the field respectively. The "north" (N) sampler was positioned in the "small tree" area of the 8.5 acre plot (where no application was performed) approximately 18 yards from the treated area. The west, north and south samplers were at the same elevation as the field while the east sampler was positioned on a small levee approximately 2.5 feet above the field. The meteorological station was positioned approximately 50 yards west of the north-east corner of the plot.

The meteorological station was set up to determine wind speed and direction, relative humidity and air temperature. This station continued to operate continuously throughout the sampling period collecting data at 1 minute intervals using a data logger. The meteorological station data will be forwarded along with this report on a 1.44 MB diskette (comma delimitted format). Appendix VII (appendices pg. 102) lists the meteorological station data in 15 minute averages for the approximately 72 hour test period. Figure 3 summarizes the wind speed and direction data as wind roses. ARB staff noted the degree of cloud cover at the start of application and whenever sample cartridges were changed. The skies were clear during the entire monitoring period.

B. Ambient Monitoring

The use patterns for endosulfan suggested that ambient monitoring may take place in Fresno County during a 30- to 45-day sampling period in the months of July and August. Sampling sites were selected based on their proximity to cotton or grape growing areas. Four sampling sites were selected in relatively high-population areas or in areas frequented by people. Background samples were collected in an area distant to endosulfan applications. Replicate (collocated) samples were collected for five dates at each sampling location. The five sites are listed in Table 3 (also see Figure 1).

	TABLE 3. Ambient Sampling Sites
CC	Cantua Creek School 19288 W. Clarkson Ave. Cantua Creek, 93608 Range/Township/Section: 15E/16S/27-SW1/4 of SE1/4 Ron Garcia, District Superintendent (209) 829-3331
WE	Westside Elementary School 19191 Excelsior Avenue Five Points, CA 93624 Range/Township/Section: 17E/17S/22-SE1/4 of SE1/4 Baldomero Hernandez, Principal (209) 884-2492
SJ	San Joaquin Elementary School 8535 S. 9th San Joaquin, 93660 Range/Township/Section: 16E/15S/23-SE1/4 of SE1/4 Carlos Navarrette, Principal (209) 693-4321
TQ	Tranquility High School 6052 Juanche Tranquility, 93668 Mailing address: P.O. Box 457 Range/Township/Section: 16E/15S/8-NW1/4 of NW1/4 John Crider, Principal (209) 698-7205
ARB	Air Resources Board, Ambient Air Monitoring Station 3425 N First, Suit 205B Fresno, 93726-6819 (Background Site) Range/Township/Section: 20E/13S/22-SE1/4 of SE1/4 Peter Ouchida (916) 322-3719

The Cantua Creek School is situated in the sparsely populated area of Cantua Creek. The school is surrounded on all sides (approximately 50 to 100 yards) by farmland. There were no grapes in the near vicinity but cotton is grown in the area. The sampling unit was placed on the roof of a single story classroom building and the sample height was approximately 1.5 meters above the roof.

The Westside Elementary School is situated in the sparsely populated area of Five Points. The school is surrounded on all sides (approximately 50 to 100 yards) by farmland. There were no grapes in the near vicinity but cotton is grown in the area. The sampling unit was placed on the roof of a single story classroom building and the sample height was approximately 1.5 meters above the roof.

The San Joaquin Elementary School is located in a residential area of San Joaquin. There are no crops grown in the immediate area surrounding the school but cotton is grown in all directions at a distance of approximately 3/4 to 1 mile. The sampling unit was placed on the roof of a single story classroom building and the sample height was approximately 1.5 meters above the roof.

The Tranquility High School is located in a residential area of Tranquility. There are no crops grown in the immediate area surrounding the school but cotton is grown in all directions at a distance of approximately 1 to 2 miles. The sampling unit was placed on the top of a railroad car/storage unit and the sample height was approximately 1.5 meters above the roof.

The background monitoring was conducted at the ARB's ambient air monitoring station in downtown Fresno. The sampler was placed on a second story roof near other ARB monitoring equipment and the sample height was approximately 1.5 meters above the roof.

The samples were collected by ARB personnel over a five week period from July 29 - August 29, 1996. Twenty-four hour samples were taken Monday through Friday (4 samples/week) at a flow rate of 2.0 liters per minute.

IV. Analytical Methodology Summary

The exposed XAD-2 resin tubes are stored in an ice chest on dry ice or freezer until desorbed with 3 mL of isooctane. A gas chromatograph with a DB-608 capillary column and an electron capture detector is used for the analyses. Refer to the analytical SOP attached in Appendix I (appendices pg. 8) for specific details.

V. Application and Ambient Results

Quality assurance results are discussed below in Section VII.

Tables 4 and 7 present the results of application and ambient air monitoring for endosulfan I and II. Summaries of sample results for endosulfan I and II are reported in Tables 5 (application) and 8 (ambient). Sample results equal to or greater than the limit of quantitation (LOQ) are reported in units of ng/m^3 and pptv to 2 significant figures. Results below the limit of quantitation (LOQ) but equal to or above the limit of detection (LOD) are reported as "detected". Analyses were also conducted for endosulfan sulfate but the results have not been included in the Tables. Endosulfan sulfate was "detected" in seven of the application samples and was not detected in any ambient samples. The result of sample 5WE is not reported due to breakage/loss of the sample during the extraction procedure. The results of samples 16ARB, 16CC, 16SJ, 16TQ and 16WE are not reported due to an instrument malfunction during analyses of these samples (the analyst apparently forgot to rerun these samples after the instrument was fixed).

The equation used to convert air concentration from units of ng/m^3 to pptv at 1 atmosphere and 25 °C is:

$$pptv = (ng/m^3) \times \frac{(0.0820575 \text{ liter-atm/mole-°K})(298 °K)}{(1 \text{ atm})(460.92 \text{ gram/mole})} = (ng/m^3) \times (0.0531)$$

A. Application Results

Application sample results are also summarized as associated with each sampling period "wind rose" in Figure 3. The "spokes" of the wind roses correspond to the compass direction of origin of the wind. For example, the wind was predominantly from the west during the background sampling period. The segments of each spoke correspond to incremental increases in wind speed of 2 mph each. The length of the spoke (and each segment) corresponds to the portion of the sampling time that the wind was from that direction (at that velocity).

Analyses for the application samples were performed by the California Department of Food and Agriculture's (CDFA) Worker Health and Safety Laboratory. For the application data, the CDFA calculated the LOD (in their report they call it the minimum detection limit) by: LOD = 5 x Noise. For this data set the LOQ is defined as 3.3 times the LOD. The analytical LODs for endosulfan I and II were 3.0 ng and 6.0 ng per sample respectively. The analytical LOQs for endosulfan I and II were 10 ng and 19 ng per sample respectively. The method LOD and LOQ, expressed in units of ng/m^3 (pptv), are dependent on the volume of air sampled, which varies from sample to sample. The method LODs for an 8-hour sampling period at 2 Lpm would be 3.1 ng/m^3 (0.16 pptv) and 6.2 ng/m^3 (0.33 pptv) for endosulfan I and II respectively. The method LOQs for an 8-hour sampling period at 2.0 Lpm would be 10 ng/m^3 (0.53 pptv) and 20 ng/m^3 (1.1 pptv) for endosulfan I and II respectively.

Results of the four application background samples were found to be below the LOD for both endosulfan I and II. Results for thirty-four of the thirty-five application samples were above the LOQ for endosulfan I and twenty of the thirty-five application samples were above the LOQ for endosulfan II. The highest endosulfan I concentration, 3800 ng/m^3 (200 pptv), was observed at the east sampling site during the third sampling period (+ 4 hour). The highest endosulfan II concentration, 200 ng/m^3 (11 pptv), was also observed at the east sampling site during the third sampling period (+ 4 hour). Endosulfan sulfate was not found above the LOQ of 19 ng/sample in any of the application samples.

B. Ambient Results

Analyses for the ambient samples were performed by the ARB Testing Section laboratory. The LOD calculation used by the Testing Section Laboratory for the ambient data was: $LOD = X_{intercept} + 3(SD)$. The LOQ is defined as 3.3 times the LOD. Refer to the analytical SOP attached in Appendix I (appendices pg. 10) for specific LOD calculation details. The analytical LODs for endosulfan I and II were 3.3 ng/sample and 11 ng/sample respectively. The analytical LOQs for endosulfan I and II were 11 ng/sample and 36 ng/sample respectively. The method LOD and LOQ, expressed in units of ng/m^3 (pptv), are dependent on the volume of air sampled, which varies from sample to sample. The method LODs for a 24-hour sampling period at 2 Lpm would be 1.2 ng/m^3 (0.058 pptv) and 3.8 ng/m^3 (0.20 pptv) for endosulfan I and II respectively. The method LOQs for a 24-hour sampling period at 2.0 Lpm would be 3.8 ng/m^3 (0.20 pptv) and 12 ng/m^3 (0.64 pptv) for endosulfan I and II respectively.

The results of the ambient monitoring are provided in Tables 7 and 8. None of the nineteen samples collected at the urban background (ARB) site had endosulfan I or II results above the LOQ. Two of the background site samples had "detected" results for endosulfan I (none for endosulfan II). For endosulfan I, of the seventy-five ambient samples taken (spikes, blanks, collocated, "not reported" and background site samples excluded), sixty-six (88%) were found to be above the LOQ, nine (12%) were found to be "detected" and none (0%) were found to be below the LOD. For endosulfan II, two (3%) of the seventy-five samples were above the LOQ, twenty-nine (39%) were found to be "detected" and forty-four (59%) were found to be below the LOD. The highest values observed for the study were 140 ng/m^3 (7.4 pptv) and 26 ng/m^3 (1.4 pptv) for endosulfan I and II respectively at the San Joaquin Elementary School on August 8, 1996. Endosulfan sulfate was not found above the LOQ of 37 ng/sample in any of the ambient samples.

VI. Quality Assurance

Field quality control (QC) for the application monitoring included:

1) four field spikes (same environmental and experimental conditions as those occurring at the time of ambient sampling) prepared by the CDFA staff (the field spikes were collocated with the background samples),
2) four trip spikes prepared by the CDFA staff,
3) four lab spikes prepared by the CDFA staff,
4) replicate samples (collocated) collected at one of the four sampling sites for all sampling periods,
5) four background samples, and
6) a trip blank.

The DPR's March 20, 1996 memo, "Monitoring Recommendation for Endosulfan", stated that "Field blank and field spike samples should be collected at the same environmental (temperature, humidity, exposure to sunlight) and experimental (similar air flow rates) conditions as those occurring at the time of sampling." Actual field spike samples were collected and the background samples were collected at the same environmental and experimental conditions as those occurring at the time of background sampling. However, no "field blanks" were collected. Collection of true field blanks would involve rather complicated procedures and is not practical under field conditions. The trip blank was collected at the time of the sampling but did not experience the same environmental and experimental conditions except for transport and storage.

Field QC for the ambient monitoring included:

1) four field spikes (same environmental and experimental conditions as those occurring at the time of ambient sampling) prepared by the QMOSB and spiked at two different levels; the field spikes were obtained by sampling ambient air at the background monitoring site for 24 hour periods at 2.0 L/minute (collocated with an ambient sample);
2) eight trip spikes prepared by the QMOSB and spiked at two different levels;

3) six lab spikes prepared by the QMOSB and spiked at three different levels;

4) a QMOSB collocated "blank" (a nonspiked tube collocated with the ambient background), a trip blank and a lab blank,
5) replicate (collocated) samples taken for five dates at each sampling location; and
6) trip blanks collected once per week (see comment above regarding field blanks).

The instrument dependent parameters (reproducibility, linearity and LOD) are discussed in the SOP (appendices pg. 8) and in the CDFA analytical report (appendices pg. 27). A chain of custody sheet accompanied all samples. Rotameters were calibrated as outlined in the "Quality Assurance Plan for Pesticide Monitoring" (appendices pg. 16). Refer to Appendix III, "Final Endosulfan 1996 QA Audit Report", (appendices pg. 73) for rotameter flow audit results.

VII. Quality Assurance Results

A. Method Development

Refer to Appendix I, Attachment A, "Standard Operating Procedure for the Analysis of Endosulfan in Ambient Air", (appendices pg. 8) for discussion and results of method development studies.

B. Trip Blanks

The *application* trip blank was less than the LOQ of 10 and 19 ng/m^3 for endosulfan I and II respectively. All *ambient* trip blank results were less than the LOQ of 11 and 36 ng/m^3 for endosulfan I and II respectively.

C. Application Background Sample Results

All of the application background samples were below the LOD for both endosulfan I and II.

D. Collocated Sample Results

The results of application and ambient collocated samples are listed in Table 6 and Table 9 respectively. The relative difference (RD = difference/average x 100) is listed for both endosulfan I and II. There are no established acceptance criteria for collocated samples for this program. Generally though, relative difference results of up to 40% (i.e., the average ± 20%) are reasonable.

For the application study, seven pairs of collocated samples were collected. For endosulfan I, all seven pairs had a relative difference of less than 40%. For endosulfan II, one pair was detected, two pairs were <LOD, three pairs had a relative difference of 40% or less and the remaining pair had a relative difference of 80%.

For the ambient study, twenty-five pairs of collocated samples were collected. For

endosulfan I, six of the pairs were below the LOD, one pair was detected and the remaining pairs had a relative difference of less than 40%. For endosulfan II, eight of the pairs were detected, sixteen of the pairs were below the LOD and the remaining pair had a relative difference of 2.7%.

E. Laboratory Spikes

Laboratory spikes are prepared at the same time and at the same level as the trip spike and field spike sets. The laboratory spikes are kept in a freezer until extraction and analysis. The extraction and analysis of laboratory, trip and field spikes normally occurs at the same time. Laboratory spikes for the ambient study were prepared by QMOSB staff. Laboratory spikes for the application study were prepared by CDFA staff.

1) QMOSB Ambient Laboratory Spikes

The results of the six QMOSB laboratory spikes, fortified with endosulfan I, II and endosulfan sulfate, are listed in Table 10 (and appendices pg. 76). Refer to Appendix III (appendices pg. 74) for a discussion of these sample results. The average recovery of endosulfan I was 26%, the average recovery of endosulfan II was 105% and the average recovery of endosulfan sulfate was 71%. The results for endosulfan I indicate that there was a problem in the preparation of the lab spikes. The QA Report, Appendix III, infers that the endosulfan I spiking standard may not have been allowed to equilibrate to room temperature before being used to make the lab spikes. This explanation might be correct but cannot be substantiated. This temperature equilibration problem may have occured only in association with the QA spike samples. Equilibration of calibration standards to room temperature was standard practice in the analysis of ambient and application samples. Also, the storage stability study results as presented in the SOP (appendices pg. 12) showed no loss of endosulfan I from spiked cartridges after 20 days of storage in the freezer.

2) CDFA Application Laboratory Spikes

The results of the four CDFA laboratory spikes, fortified with endosulfan I and II, are listed in Table 13 (and appendices pg. 37). The average recovery of endosulfan I was 83% and the average recovery of endosulfan II was 62%. These results indicate that the sample storage and analytical procedures used in this study produce acceptable results for endosulfan I and II.

F. Trip Spikes

Trip spikes are prepared at the same time and at the same level as the laboratory spike and field spike sets. The trip spikes are kept in a freezer until transported to the field. The trip spike samples are kept on dry ice in an ice chest (the same one used for samples) during transport to and from the field and at all times while in the field except for trip spike sample log-in and labeling. Trip spikes for the ambient study were prepared by QMOSB staff and trip spikes for the application study were prepared by CDFA staff.

1) QMOSB Ambient Trip Spikes

The results of the ten QMOSB trip spikes, fortified with endosulfan I and II are listed in Table 11 (and appendices pg. 77). Refer to Appendix III (appendices pg. 76) for a discussion of these sample results. The average recovery of endosulfan I was 11% and the average recovery of endosulfan II was 39%. The results for endosulfan I and II indicate that there was a problem in the preparation of the trip spikes. The QA Report, Appendix III, infers that the endosulfan I and II spiking standards may not have been allowed to equilibrate to room temperature before being used to make the trip spikes. This explanation might be correct but cannot be substantiated. This temperature equilibration problem may have occured only in association with the QA spike samples. Equilibration of calibration standards to room temperature was standard practice in the analysis of ambient and application samples.

2) CDFA Application Trip Spikes

The results of the four CDFA trip spikes, fortified with endosulfan I and II, are listed in Table 14 (and appendices pg. 37). The average recovery of endosulfan I was 82% and the average recovery of endosulfan II was 61%. These results are consistent with the CDFA lab spike results and indicate that the sample transport, storage and analytical procedures used in this study produce acceptable results for endosulfan I and II.

G. Field Spikes

Field spikes are prepared at the same time and at the same level as the laboratory spike and trip spike sets. The field spikes are kept in a freezer until transported to the field. The field spike samples are kept on dry ice in an ice chest (the same one used for samples) during transport to and from the field and at all times while in the field except for the sampling period. Field spikes were collected at the same environmental and experimental conditions as those occurring at the time of ambient sampling. The field spikes were obtained by sampling ambient air through a previously spiked cartridge. (i.e., collocated with an ambient or background sample). Field spike sets for the ambient study were prepared by QMOSB staff and field spikes for the application study were prepared by CDFA staff.

1) QMOSB Field Spikes

The results of the five QMOSB field spikes, fortified with endosulfan I and II are listed in Table 12 (and appendices pg. 78). The field spikes were collocated with samples ARB19 and ARB20 which had results of <LOD for both endosulfan I and II. Refer to Appendix III (appendices pg. 78) for a discussion of these sample results. The average recovery of endosulfan I was 44% and the average recovery of endosulfan II was 83%. The results for endosulfan I indicate that there was a problem in the preparation of the field spikes. The QA Report, Appendix III, infers that the endosulfan I spiking standard may not have been allowed to equilibrate to room temperature before being used to make the field spikes. This explanation might be correct but cannot be substantiated. This temperature equilibration problem may have occured only in association with the

QA spike samples. Equilibration of calibration standards to room temperature was standard practice in the analysis of ambient and application samples. Also, the collection and extraction efficiency study results as presented in the SOP (appendices pg. 11) showed 95% recovery of endosulfan I from spiked cartridges after being subjected to an air flow of 2 Lpm for 24 hours.

2) CDFA Field Spikes

The results of the four CDFA field spikes, fortified with endosulfan I and II, are listed in Table 15 (and appendices pg. 37). The field spikes were collocated with four application background samples which all had results of <LOD for both endosulfan I and II. The average recovery of endosulfan I was 85% and the average recovery of endosulfan II was 62%. These results are consistent with the CDFA lab and trip spike results and indicate that the sampling, sample transport, storage and analytical procedures used in this study produce acceptable results for endosulfan I and II.

FIGURE 1. ENDOSULFAN AMBIENT MONITORING SITES

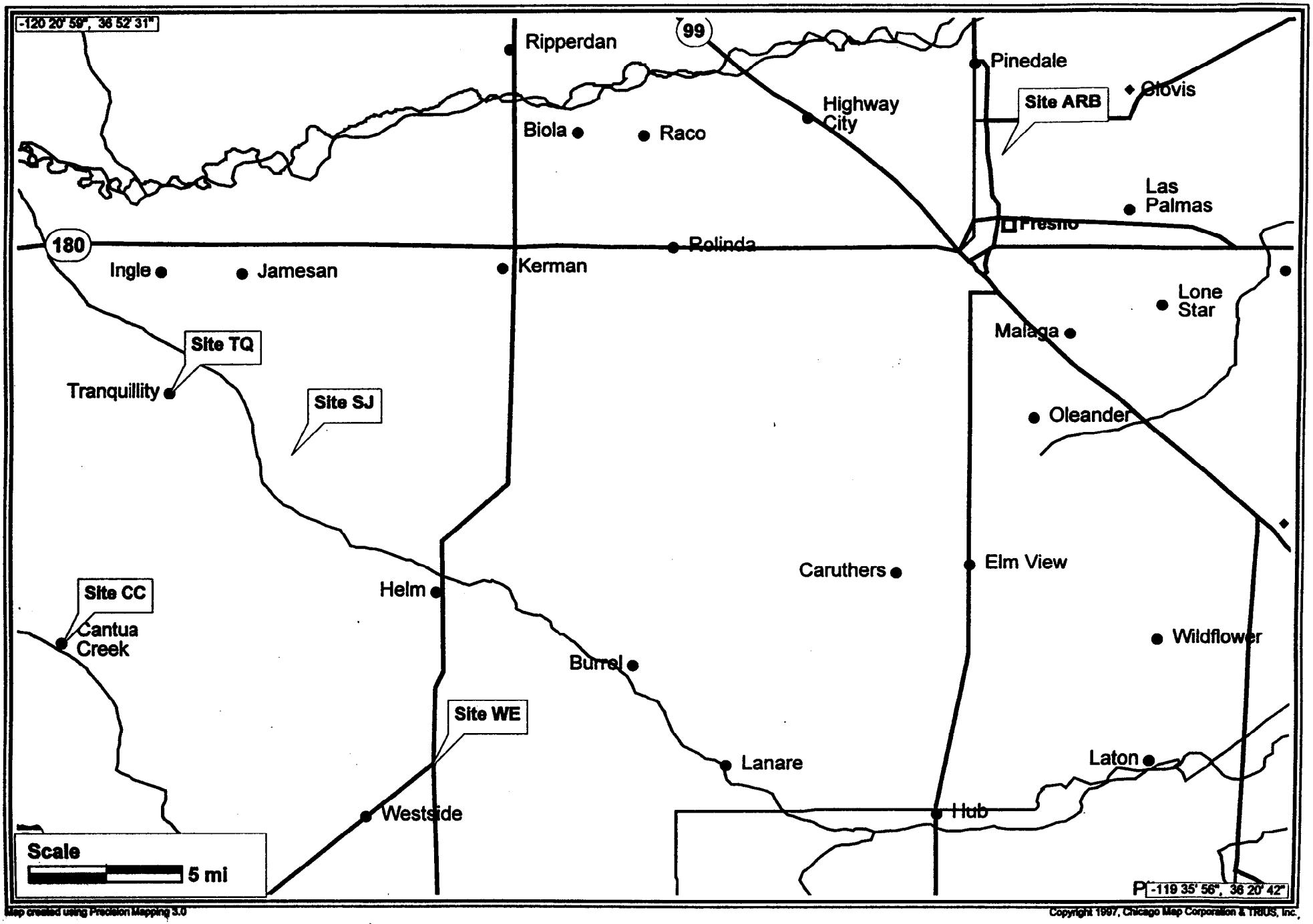


FIGURE 2
ENDOSULFAN APPLICATION SITE

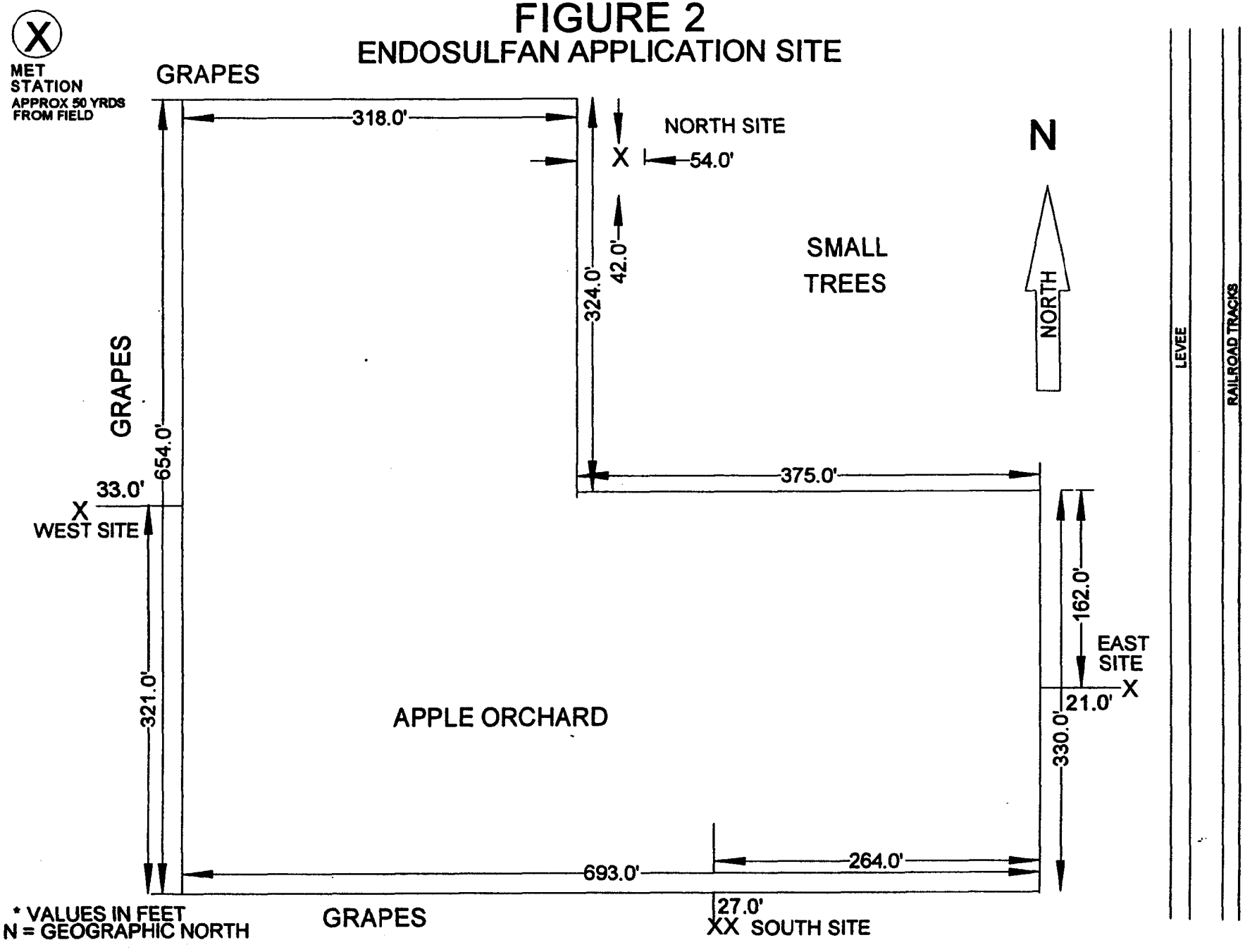


FIGURE 3. ENDOSULFAN APPLICATION DATA (ng/m3)

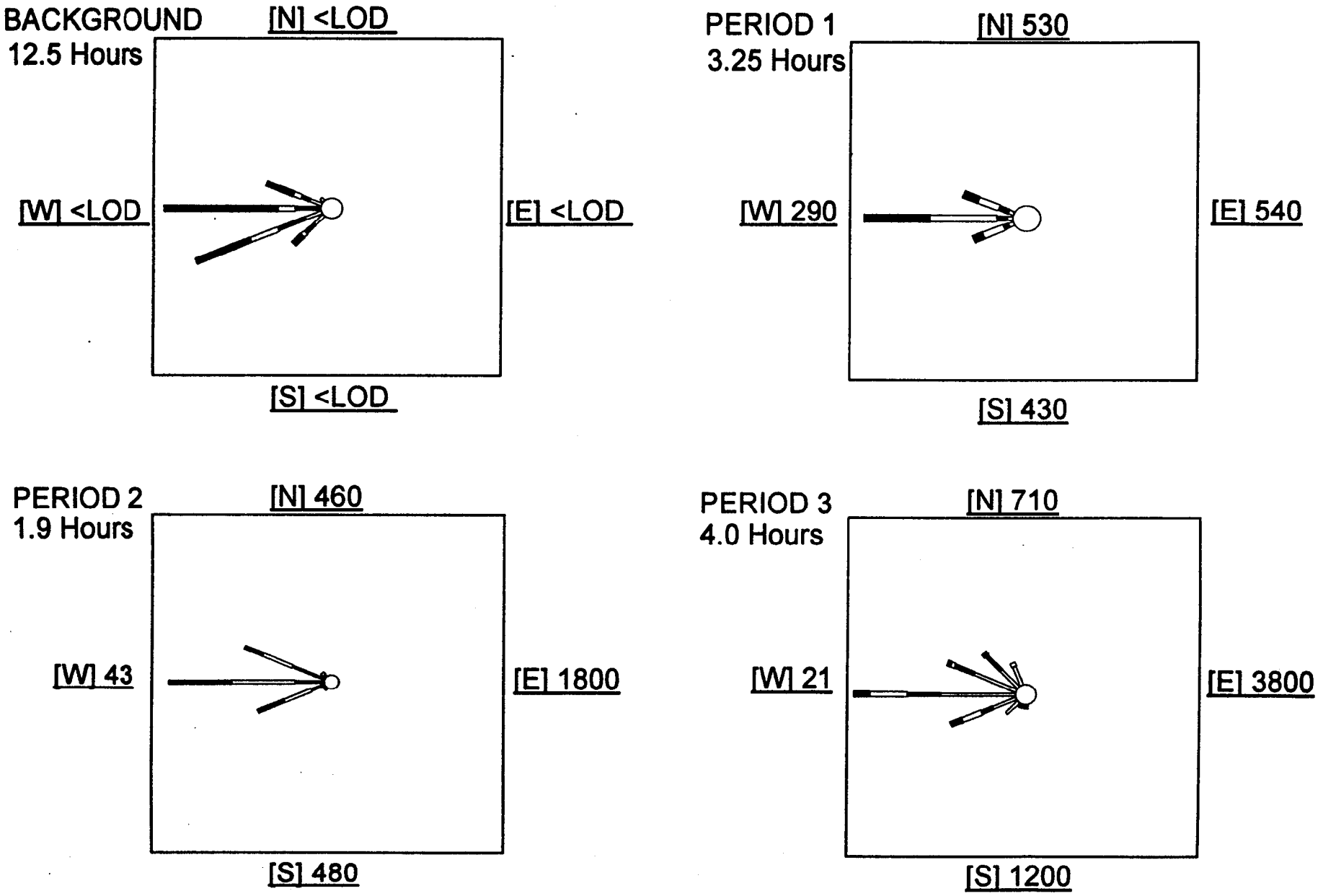
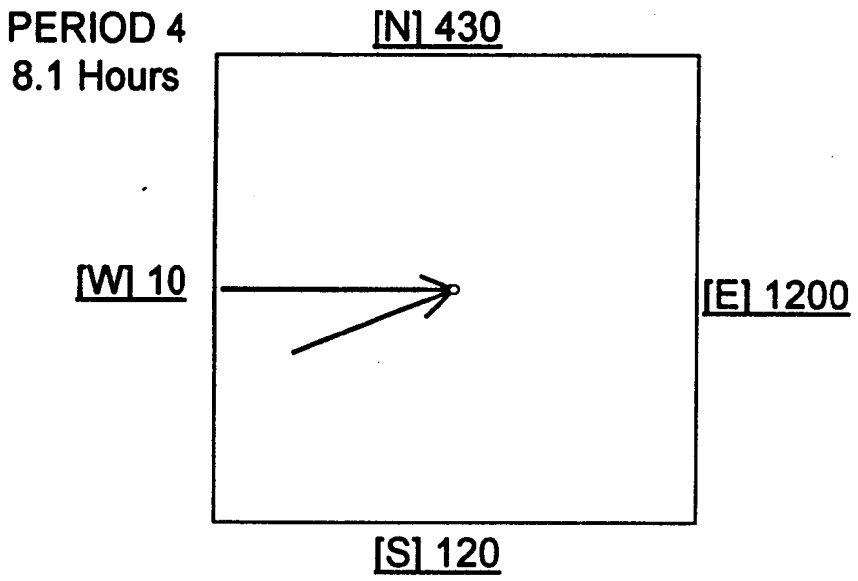
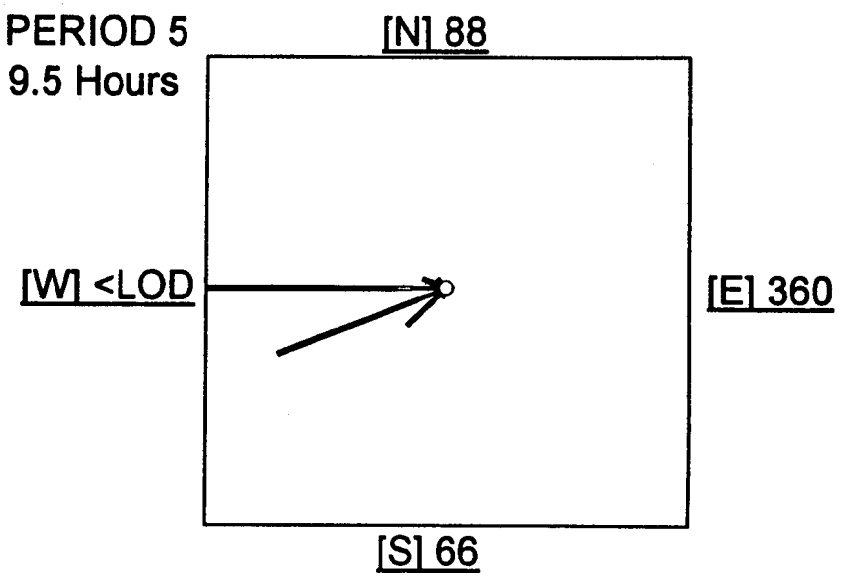
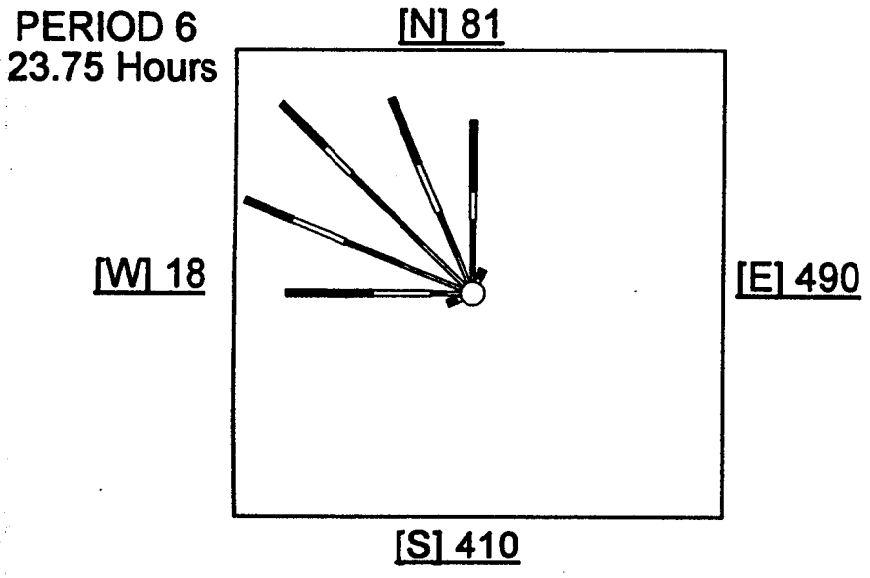


FIGURE 3. ENDOSULFAN APPLICATION DATA (ng/m3)







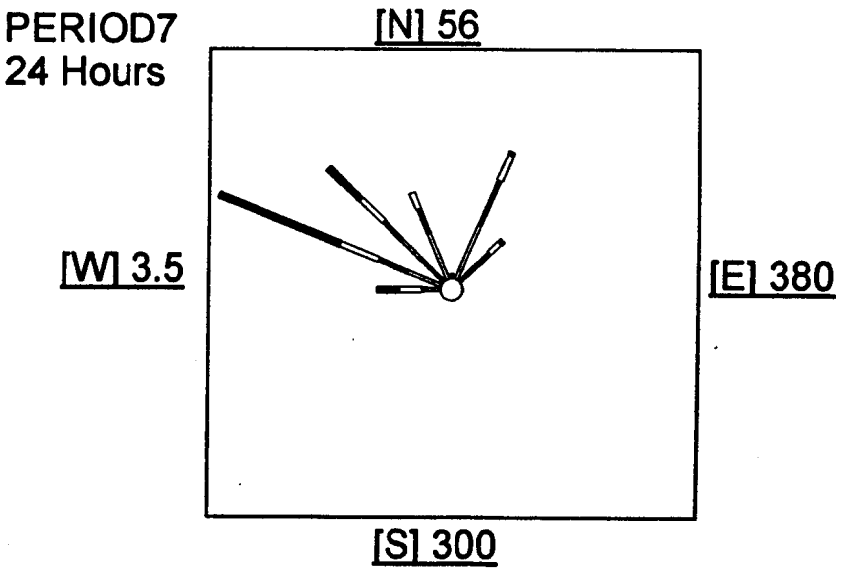


Table 4. Endosulfan Application Monitoring Results

Log #	Sample ID	Start Date/Time	End Date/Time	Sample Time (minutes)	Sample Volume (m3)	Endo-I (ng)	(ng/m3)	*pptv	Endo-II (ng)	(ng/m3)	*pptv
13	end-EB2	4/07/97 17:05	4/08/97 05:30	745	1.49	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
14	end-SB2	4/07/97 17:00	4/08/97 05:20	740	1.48	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
15	end-WB2	4/07/97 17:15	4/08/97 05:15	720	1.44	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
16	end-NB2	4/07/97 17:25	4/08/97 05:40	735	1.47	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
17	end-W1	4/08/97 05:15	4/08/97 08:45	210	0.42	120	290	15	20	48	2.5
18	end-S1	4/08/97 05:20	4/08/97 08:50	210	0.42	150	360	19	30	71	3.8
19	end-S1D	4/08/97 05:20	4/08/97 08:50	210	0.42	210	500	27	40	95	5.1
20	end-E1	4/08/97 05:30	4/08/97 08:55	205	0.41	220	540	29	30	73	3.9
21	end-N1	4/08/97 05:40	4/08/97 09:00	200	0.40	210	530	28	30	75	4.0
22	end-W2	4/08/97 08:45	4/08/97 10:40	115	0.23	10	43	2.3	<LOD	<LOD	<LOD
23	end-S2	4/08/97 08:50	4/08/97 10:45	115	0.23	100	440	23	<LOD	<LOD	<LOD
24	end-S2D	4/08/97 08:50	4/08/97 10:45	115	0.23	120	520	28	<LOD	<LOD	<LOD
25	end-E2	4/08/97 08:55	4/08/97 10:45	110	0.22	390	1800	96	20	91	4.8
26	end-N2	4/08/97 09:00	4/08/97 10:50	110	0.22	100	460	24	<LOD	<LOD	<LOD
27	end-W3	4/08/97 10:40	4/08/97 14:40	240	0.48	10	21	1.1	<LOD	<LOD	<LOD
28	end-S3	4/08/97 10:45	4/08/97 14:45	240	0.48	550	1200	64	20	42	2.2
29	end-S3D	4/08/97 10:45	4/08/97 14:45	240	0.48	630	1300	69	30	62	3.3
30	end-E3	4/08/97 10:45	4/08/97 14:50	245	0.49	1900	3800	200	100	200	11
31	end-N3	4/08/97 10:50	4/08/97 14:55	245	0.49	350	710	38	20	41	2.2
32	end-W4	4/08/97 14:40	4/08/97 22:45	485	0.97	10	10	0.55	<LOD	<LOD	<LOD
33	end-S4	4/08/97 14:45	4/08/97 22:50	485	0.97	100	100	5.3	Det.	Det.	Det.
34	end-S4D	4/08/97 14:45	4/08/97 22:50	485	0.97	140	140	7.4	Det.	Det.	Det.
35	end-E4	4/08/97 14:50	4/08/97 22:50	480	0.96	1200	1200	64	70	73	3.9
36	end-N4	4/08/97 14:55	4/08/97 23:00	485	0.97	420	430	23	30	31	1.6
37	end-W5	4/08/97 22:45	4/09/97 08:15	570	1.14	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
38	end-S5	4/08/97 22:50	4/09/97 08:20	570	1.14	70	61	3.3	<LOD	<LOD	<LOD
39	end-S5D	4/08/97 22:50	4/09/97 08:20	570	1.14	80	70	3.7	<LOD	<LOD	<LOD

LOD = 3.0 ng per sample for Endosulfan I and 6.0 ng per sample for Endosulfan II
Det. = <10 ng (LOQ) but >3.0 ng (LOD) for Endosulfan I
= <19 ng (LOQ) but >6.0 ng (LOD) for Endosulfan II
* pptv at 25 C and 1 atm

Table 4. Endosulfan Application Monitoring Results

Log #	Sample ID	Start Date/Time	End Date/Time	Sample Time (minutes)	Sample Volume (m3)	Endo-I (ng)	(ng/m3)	*pptv	Endo-II (ng)	(ng/m3)	*pptv
40	end-E5	4/08/97 22:55	4/09/97 08:25	570	1.14	410	360	19	20	18	0.93
41	end-N5	4/08/97 23:00	4/09/97 08:30	570	1.14	100	88	4.7	Det.	Det.	Det.
42	end-W6	4/09/97 08:15	4/10/97 08:00	1425	2.85	50	18	0.93	<LOD	<LOD	<LOD
43	end-S6	4/09/97 08:20	4/10/97 08:05	1425	2.85	970	340	18	60	21	1.1
44	end-S6D	4/09/97 08:20	4/10/97 08:05	1425	2.85	1400	490	26	140	49	2.6
45	end-E6	4/09/97 08:25	4/10/97 08:10	1425	2.85	1400	490	26	100	35	1.9
46	end-N6	4/09/97 08:30	4/10/97 08:15	1425	2.85	230	81	4.3	20	7.0	0.37
47	end-W7	4/10/97 08:00	4/11/97 08:00	1440	2.88	10	3.5	0.18	<LOD	<LOD	<LOD
48	end-S7	4/10/97 08:05	4/11/97 08:05	1440	2.88	830	290	15	100	35	1.8
49	end-S7D	4/10/97 08:05	4/11/97 08:05	1440	2.88	880	300	16	120	42	2.2
50	end-E7	4/10/97 08:10	4/11/97 08:10	1440	2.88	1100	380	20	110	38	2.0
51	end-N7	4/10/97 08:15	4/11/97 08:15	1440	2.88	160	56	2.9	<LOD	<LOD	<LOD

LOD = 3.0 ng per sample for Endosulfan I and 6.0 ng per sample for Endosulfan II
Det. = <10 ng (LOQ) but >3.0 ng (LOD) for Endosulfan I
= <19 ng (LOQ) but >6.0 ng (LOD) for Endosulfan II
* pptv at 25 C and 1 atm

Table 5. Summary of Endosulfan Application Results (ng/m3)

Sampling Period	East		North		South*		West	
	Endo-I	Endo-II	Endo-I	Endo-II	Endo-I)	Endo-II	Endo-I	Endo-II
Background	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
1	540	73	530	75	430	83	290	48
2	1800	91	460	<LOD	480	<LOD	43	<LOD
3	3800	200	710	41	1200	52	21	<LOD
4	1200	73	430	31	120	Det.	10	<LOD
5	360	18	88	Det.	66	<LOD	<LOD	<LOD
6	490	35	81	7.0	410	35	18	<LOD
7	380	38	56	<LOD	300	38	3.5	<LOD

* Average of the collocated sample results
LOD = 3.0 ng per sample for Endosulfan I and 6.0 ng per sample for Endosulfan II
Det. = <10 ng (LOQ) but >3.0 ng (LOD) for Endosulfan I
= <19 ng (LOQ) but >6.0 ng (LOD) for Endosulfan II

Table 6. Endosulfan Application Collocated Results

Log #	Sample ID	Start Date/Time	End Date/Time	(ng/m3) Endo-I	(ng/m3) Endo-II	Average (ng/m3) Endo-I	Average (ng/m3) Endo-II	RD* Endo-I	RD* Endo-II
18	end-S1	4/08/97 05:20	4/08/97 08:50	360	71				
19	end-S1D	4/08/97 05:20	4/08/97 08:50	500	95	430	83	33%	29%
23	end-S2	4/08/97 08:50	4/08/97 10:45	440	<LOD				
24	end-S2D	4/08/97 08:50	4/08/97 10:45	520	<LOD	480	<LOD	17%	<LOD
28	end-S3	4/08/97 10:45	4/08/97 14:45	1200	42				
29	end-S3D	4/08/97 10:45	4/08/97 14:45	1300	62	1250	52	8.0%	40%
33	end-S4	4/08/97 14:45	4/08/97 22:50	100	Det.				
34	end-S4D	4/08/97 14:45	4/08/97 22:50	140	Det.	120	Det.	33%	Det.
38	end-S5	4/08/97 22:50	4/09/97 08:20	61	<LOD				
39	end-S5D	4/08/97 22:50	4/09/97 08:20	70	<LOD	66	<LOD	13%	<LOD
43	end-S6	4/09/97 08:20	4/10/97 08:05	340	21				
44	end-S6D	4/09/97 08:20	4/10/97 08:05	490	49	415	35	36%	80%
48	end-S7	4/10/97 08:05	4/11/97 08:05	290	35				
49	end-S7D	4/10/97 08:05	4/11/97 08:05	300	42	295	38	3.4%	18%

* RD = Relative Difference = (Diff./Ave.)100
LOD = 3.0 ng per sample for Endosulfan I and 6.0 ng per sample for Endosulfan II
Det. = <10 ng (LOQ) but >3.0 ng (LOD) for Endosulfan I
= <19 ng (LOQ) but >6.0 ng (LOD) for Endosulfan II

Table 7. Endosulfan Ambient Monitoring Results

Log #	Sample ID	Start Date/Time	End Date/Time	Sample Time (minutes)	Sample Volume (m3)	Endo-I (ng)	(ng/m3)	*pptv	Endo-II (ng)	(ng/m3)	*pptv
1	1CC	7/29/96 12:05	7/30/96 09:05	1260	2.52	21	8.3	0.44	<LOD	<LOD	<LOD
2	1WE	7/29/96 12:44	7/30/96 10:20	1296	2.59	22	8.5	0.45	<LOD	<LOD	<LOD
3	1SJ	7/29/96 11:25	7/30/96 09:15	1310	2.62	45	17	0.91	Det.	Det.	Det.
4	1TQ	7/29/96 11:40	7/30/96 09:30	1310	2.62	54	21	1.1	Det.	Det.	Det.
5	1ARB	7/29/96 14:00	7/30/96 08:20	1100	2.20	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
6	2CC	7/30/96 09:50	7/31/96 10:05	1455	2.91	85	29	1.6	Det.	Det.	Det.
7	2WE	7/30/96 09:50	7/31/96 10:30	1480	2.96	69	23	1.2	Det.	Det.	Det.
8	2SJ	7/30/96 09:50	7/31/96 09:20	1410	2.82	45	16	0.85	Det.	Det.	Det.
9	2TQ	7/30/96 09:50	7/31/96 09:45	1435	2.87	57	20	1.1	Det.	Det.	Det.
10	2ARB	7/30/96 09:50	7/31/96 08:30	1360	2.72	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
11	3CC	7/31/96 10:05	8/01/96 10:00	1435	2.87	100	35	1.8	Det.	Det.	Det.
12	3CC-D	7/31/96 10:05	8/01/96 10:00	1435	2.87	99	34	1.8	Det.	Det.	Det.
13	3WE	7/31/96 10:30	8/01/96 10:35	1445	2.89	51	18	0.94	<LOD	<LOD	<LOD
14	3WE-D	7/31/96 10:30	8/01/96 10:35	1445	2.89	35	12	0.64	<LOD	<LOD	<LOD
15	3SJ	7/31/96 09:20	8/01/96 09:15	1435	2.87	33	11	0.61	Det.	Det.	Det.
16	3SJ-D	7/31/96 09:20	8/01/96 09:15	1435	2.87	36	13	0.67	Det.	Det.	Det.
17	3TQ	7/31/96 09:45	8/01/96 09:35	1430	2.86	42	15	0.78	Det.	Det.	Det.
18	3TQ-D	7/31/96 09:45	8/01/96 09:35	1430	2.86	39	14	0.72	Det.	Det.	Det.
19	3ARB	7/31/96 08:30	8/01/96 08:30	1440	2.88	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
20	3ARB-D	7/31/96 08:30	8/01/96 08:30	1440	2.88	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
21	4CC	8/01/96 10:00	8/02/96 10:00	1440	2.88	30	10	0.55	<LOD	<LOD	<LOD
22	4WE	8/01/96 10:35	8/02/96 10:25	1430	2.86	39	14	0.72	<LOD	<LOD	<LOD
23	4SJ	8/01/96 09:15	8/02/96 09:20	1445	2.89	45	16	0.83	Det.	Det.	Det.
24	4TQ	8/01/96 09:35	8/02/96 09:35	1440	2.88	20	6.9	0.37	<LOD	<LOD	<LOD
25	4ARB	8/01/96 08:30	8/02/96 08:30	1440	2.88	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
26	BLANK	8/02/96 10:30	8/02/96 10:30	0	0.00	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
27	5CC	8/05/96 12:50	8/06/96 10:55	1325	2.65	72	27	1.4	Det.	Det.	Det.

LOD = 3.3 ng per sample for Endosulfan I and 11 ng per sample for Endosulfan II
Det. = <11 ng (LOQ) but >3.3 ng (LOD) for Endosulfan I
= <36 ng (LOQ) but >11 ng (LOD) for Endosulfan II
*pptv at 25 C and 1 atm
NR = Not Reported

Table 7. Endosulfan Ambient Monitoring Results

Log #	Sample ID	Start Date/Time	End Date/Time	Sample Time (minutes)	Sample Volume (m3)	Endo-I (ng)	(ng/m3)	*pptv	Endo-II (ng)	(ng/m3)	*pptv
28	5WE	8/05/96 13:10	8/06/96 10:20	1270	2.54	NR	NR	NR	NR	NR	NR
29	5SJ	8/05/96 12:00	8/06/96 10:55	1375	2.75	12	4.4	0.23	<LOD	<LOD	<LOD
30	5TQ	8/05/96 12:25	8/06/96 10:55	1350	2.70	110	41	2.2	Det.	Det.	Det.
31	5ARB	8/05/96 14:50	8/06/96 10:55	1205	2.41	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
32	6CC	8/06/96 10:55	8/07/96 10:45	1430	2.86	69	24	1.3	Det.	Det.	Det.
33	6WE	8/06/96 11:20	8/07/96 11:15	1435	2.87	42	15	0.78	<LOD	<LOD	<LOD
34	6SJ	8/06/96 10:10	8/07/96 10:00	1430	2.86	100	35	1.9	Det.	Det.	Det.
35	6TQ	8/06/96 10:30	8/07/96 10:20	1430	2.86	200	70	3.7	Det.	Det.	Det.
36	6ARB	8/06/96 08:40	8/07/96 08:40	1440	2.88	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
37	7CC	8/07/96 10:45	8/08/96 09:55	1390	2.78	63	23	1.2	Det.	Det.	Det.
38	7CC-D	8/07/96 10:45	8/08/96 09:55	1390	2.78	63	23	1.2	Det.	Det.	Det.
39	7WE	8/07/96 11:15	8/08/96 10:25	1390	2.78	36	13	0.69	<LOD	<LOD	<LOD
40	7WE-D	8/07/96 11:15	8/08/96 10:25	1390	2.78	42	15	0.80	<LOD	<LOD	<LOD
41	7SJ	8/07/96 10:00	8/08/96 09:15	1395	2.79	350	130	6.9	37	13	0.70
42	7SJ-D	8/07/96 10:00	8/08/96 09:15	1395	2.79	330	120	6.4	36	13	0.68
43	7TQ	8/07/96 10:20	8/08/96 09:30	1390	2.78	93	33	1.8	Det.	Det.	Det.
44	7TQ-D	8/07/96 10:20	8/08/96 09:30	1390	2.78	96	35	1.8	Det.	Det.	Det.
45	7ARB	8/07/96 08:40	8/08/96 08:00	1400	2.80	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
46	7ARB-D	8/07/96 08:40	8/08/96 08:00	1400	2.80	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
47	8CC	8/08/96 09:55	8/09/96 09:55	1440	2.88	49	17	0.90	Det.	Det.	Det.
48	8WE	8/08/96 10:25	8/09/96 09:40	1395	2.79	48	17	0.91	Det.	Det.	Det.
49	8SJ	8/08/96 09:15	8/09/96 08:45	1410	2.82	380	140	7.4	72	26	1.35
50	8TQ	8/08/96 09:30	8/09/96 08:55	1405	2.81	98	35	1.9	Det.	Det.	Det.
51	8ARB	8/08/96 08:00	8/09/96 07:30	1410	2.82	Det.	Det.	Det.	<LOD	<LOD	<LOD
52	BLANK	8/09/96 09:45	8/09/96 09:45	0	0.00	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
53	9CC	8/12/96 10:30	8/13/96 10:05	1415	2.83	51	18	1.0	Det.	Det.	Det.
54	9WE	8/12/96 00:00	8/13/96 10:35	2075	4.15	33	8.0	0.42	<LOD	<LOD	<LOD

LOD = 3.3 ng per sample for Endosulfan I and 11 ng per sample for Endosulfan II

Det. = <11 ng (LOQ) but >3.3 ng (LOD) for Endosulfan I

= <36 ng (LOQ) but >11 ng (LOD) for Endosulfan II

*pptv at 25 C and 1 atm

NR = Not Reported

Table 7. Endosulfan Ambient Monitoring Results

Log #	Sample ID	Start Date/Time	End Date/Time	Sample Time (minutes)	Sample Volume (m3)	Endo-I (ng)	(ng/m3)	*pptv	Endo-II (ng)	(ng/m3)	*pptv
55	9SJ	8/12/96 11:15	8/13/96 09:30	1335	2.67	36	13	0.72	Det.	Det.	Det.
56	9TQ	8/12/96 11:00	8/13/96 09:40	1360	2.72	22	8.1	0.43	<LOD	<LOD	<LOD
57	9ARB	8/12/96 13:00	8/13/96 08:40	1180	2.36	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
58	10CC	8/13/96 10:05	8/14/96 09:50	1425	2.85	57	20	1.1	Det.	Det.	Det.
59	10WE	8/13/96 10:35	8/14/96 10:15	1420	2.84	28	10	0.52	<LOD	<LOD	<LOD
60	10SJ	8/13/96 09:30	8/14/96 09:15	1425	2.85	54	19	1.0	Det.	Det.	Det.
61	10TQ	8/13/96 09:40	8/14/96 09:30	1430	2.86	48	17	0.89	Det.	Det.	Det.
62	10ARB	8/13/96 08:40	8/14/96 08:30	1430	2.86	Det.	Det.	Det.	<LOD	<LOD	<LOD
63	11CC	8/14/96 09:50	8/15/96 09:50	1440	2.88	40	14	0.7	Det.	Det.	Det.
64	11CC-D	8/14/96 09:50	8/15/96 09:50	1440	2.88	39	14	0.7	Det.	Det.	Det.
65	11WE	8/14/96 10:15	8/15/96 10:20	1445	2.89	16	5.5	0.29	<LOD	<LOD	<LOD
66	11WE-D	8/14/96 10:15	8/15/96 10:20	1445	2.89	17	5.9	0.31	<LOD	<LOD	<LOD
67	11SJ	8/14/96 09:15	8/15/96 09:15	1440	2.88	27	9.4	0.50	<LOD	<LOD	<LOD
68	11SJ-D	8/14/96 09:15	8/15/96 09:15	1440	2.88	27	9.4	0.50	<LOD	<LOD	<LOD
69	11TQ	8/14/96 09:30	8/15/96 09:30	1440	2.88	28	10	0.52	<LOD	<LOD	<LOD
70	11TQ-D	8/14/96 09:30	8/15/96 09:30	1440	2.88	25	8.7	0.46	<LOD	<LOD	<LOD
71	11ARB	8/14/96 08:30	8/15/96 08:30	1440	2.88	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
72	11ARB-D	8/14/96 08:30	8/15/96 08:30	1440	2.88	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
73	BLANK	8/15/96 10:20	8/15/96 10:20	0	0.00	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
74	12CC	8/15/96 09:50	8/16/96 09:50	1440	2.88	26	9.0	0.48	<LOD	<LOD	<LOD
75	12WE	8/15/96 10:20	8/16/96 10:20	1440	2.88	12	4.2	0.22	<LOD	<LOD	<LOD
76	12SJ	8/15/96 09:15	8/16/96 09:15	1440	2.88	33	11	0.61	<LOD	<LOD	<LOD
77	12TQ	8/15/96 09:30	8/16/96 09:30	1440	2.88	130	45	2.4	Det.	Det.	Det.
78	12ARB	8/15/96 08:30	8/16/96 08:30	1440	2.88	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
79	13CC	8/19/96 12:05	8/20/96 10:55	1370	2.74	25	9.1	0.48	<LOD	<LOD	<LOD
80	13WE	8/19/96 12:30	8/20/96 11:20	1370	2.74	12	4.4	0.23	<LOD	<LOD	<LOD
81	13SJ	8/19/96 11:30	8/20/96 10:10	1360	2.72	Det.	Det.	Det.	<LOD	<LOD	<LOD

LOD = 3.3 ng per sample for Endosulfan I and 11 ng per sample for Endosulfan II
Det. = <11 ng (LOQ) but >3.3 ng (LOD) for Endosulfan I
= <36 ng (LOQ) but >11 ng (LOD) for Endosulfan II
*pptv at 25 C and 1 atm
NR = Not Reported

Table 7. Endosulfan Ambient Monitoring Results

Log #	Sample ID	Start Date/Time	End Date/Time	Sample Time (minutes)	Sample Volume (m3)	Endo-I (ng)	(ng/m3)	*pptv	Endo-II (ng)	(ng/m3)	*pptv
82	13TQ	8/19/96 10:35	8/20/96 10:35	1440	2.88	17	5.9	0.31	<LOD	<LOD	<LOD
83	13ARB	8/19/96 09:00	8/20/96 09:00	1440	2.88	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
84	14CC	8/20/96 10:55	8/21/96 10:55	1440	2.88	26	9.0	0.48	<LOD	<LOD	<LOD
85	14WE	8/20/96 11:20	8/21/96 11:20	1440	2.88	17	5.9	0.31	<LOD	<LOD	<LOD
86	14SJ	8/20/96 10:10	8/21/96 09:55	1425	2.85	25	8.8	0.47	<LOD	<LOD	<LOD
87	14TQ	8/20/96 10:35	8/21/96 10:20	1425	2.85	35	12	0.65	<LOD	<LOD	<LOD
88	14ARB	8/20/96 09:00	8/21/96 08:35	1415	2.83	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
89	15CC	8/21/96 10:55	8/22/96 10:20	1405	2.81	20	7.1	0.38	<LOD	<LOD	<LOD
90	15CC-D	8/21/96 10:55	8/22/96 10:20	1405	2.81	17	6.0	0.32	<LOD	<LOD	<LOD
91	15WE	8/21/96 11:20	8/22/96 11:00	1420	2.84	17	6.0	0.32	<LOD	<LOD	<LOD
92	15WE-D	8/21/96 11:20	8/22/96 11:00	1420	2.84	12	4.2	0.22	<LOD	<LOD	<LOD
93	15SJ	8/21/96 09:55	8/22/96 09:40	1425	2.85	29	10	0.54	<LOD	<LOD	<LOD
94	15SJ-D	8/21/96 09:55	8/22/96 09:40	1425	2.85	30	11	0.56	<LOD	<LOD	<LOD
95	15TQ	8/21/96 10:20	8/22/96 10:00	1420	2.84	47	17	0.88	<LOD	Det.	Det.
96	15TQ-D	8/21/96 10:20	8/22/96 10:00	1420	2.84	45	16	0.84	<LOD	Det.	Det.
97	15ARB	8/21/96 10:20	8/22/96 08:30	1330	2.66	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
98	15ARB-D	8/21/96 10:20	8/22/96 08:30	1330	2.66	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
99	16CC	8/22/96 10:20	8/23/96 09:25	1385	2.77	NR	NR	NR	NR	NR	NR
100	16WE	8/22/96 11:00	8/23/96 09:50	1370	2.74	NR	NR	NR	NR	NR	NR
101	16SJ	8/22/96 09:40	8/23/96 08:50	1390	2.78	NR	NR	NR	NR	NR	NR
102	16TQ	8/22/96 10:00	8/23/96 09:50	1430	2.86	NR	NR	NR	NR	NR	NR
103	16ARB	8/22/96 08:30	8/23/96 07:30	1380	2.76	NR	NR	NR	NR	NR	NR
104	BLANK	8/23/96 07:30	8/23/96 07:30	0	0.00	NR	NR	NR	NR	NR	NR
105	17CC	8/26/96 12:50	8/27/96 10:25	1295	2.59	Det.	Det.	Det.	<LOD	<LOD	<LOD
106	17WE	8/26/96 13:15	8/27/96 10:50	1295	2.59	Det.	Det.	Det.	<LOD	<LOD	<LOD
107	17SJ	8/26/96 12:00	8/27/96 09:50	1310	2.62	Det.	Det.	Det.	<LOD	<LOD	<LOD
108	17TQ	8/26/96 12:30	8/27/96 10:00	1290	2.58	Det.	Det.	Det.	<LOD	<LOD	<LOD

LOD = 3.3 ng per sample for Endosulfan I and 11 ng per sample for Endosulfan II

Det. = <11 ng (LOQ) but >3.3 ng (LOD) for Endosulfan I

= <36 ng (LOQ) but >11 ng (LOD) for Endosulfan II

*pptv at 25 C and 1 atm

NR = Not Reported

Table 7. Endosulfan Ambient Monitoring Results

Log #	Sample ID	Start Date/Time	End Date/Time	Sample Time (minutes)	Sample Volume (m3)	Endo-I (ng)	(ng/m3)	*pptv	Endo-II (ng)	(ng/m3)	*pptv
109	17ARB	8/26/96 14:00	8/27/96 08:35	1115	2.23	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
110	18CC	8/27/96 10:25	8/28/96 10:25	1440	2.88	Det.	Det.	Det.	<LOD	<LOD	<LOD
111	18WE	8/27/96 10:50	8/28/96 10:55	1445	2.89	Det.	Det.	Det.	<LOD	<LOD	<LOD
112	18SJ	8/27/96 09:50	8/28/96 09:35	1425	2.85	Det.	Det.	Det.	<LOD	<LOD	<LOD
113	18TQ	8/27/96 10:00	8/28/96 09:55	1435	2.87	16	5.6	0.30	<LOD	<LOD	<LOD
114	18ARB	8/27/96 08:35	8/28/96 12:30	1675	3.35	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
115	19CC	8/28/96 10:25	8/29/96 11:00	1475	2.95	13	4.4	0.23	<LOD	<LOD	<LOD
116	19CC-D	8/28/96 10:25	8/29/96 11:00	1475	2.95	14	4.7	0.25	<LOD	<LOD	<LOD
117	19WE	8/28/96 10:55	8/29/96 11:35	1480	2.96	Det.	Det.	Det.	<LOD	<LOD	<LOD
118	19WE-D	8/28/96 10:55	8/29/96 11:35	1480	2.96	Det.	Det.	Det.	<LOD	<LOD	<LOD
119	19SJ	8/28/96 09:35	8/29/96 10:05	1470	2.94	13	4.4	0.23	<LOD	<LOD	<LOD
120	19SJ-D	8/28/96 09:35	8/29/96 10:05	1470	2.94	12	4.1	0.22	<LOD	<LOD	<LOD
121	19TQ	8/28/96 09:55	8/29/96 10:40	1485	2.97	16	5.4	0.29	<LOD	<LOD	<LOD
122	19TQ-D	8/28/96 09:55	8/29/96 10:40	1485	2.97	19	6.4	0.34	<LOD	<LOD	<LOD
123	19ARB	8/28/96 12:30	8/29/96 08:40	1210	2.42	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
124	19ARB-D	8/28/96 12:30	8/29/96 08:40	1210	2.42	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
125	20CC	8/29/96 11:00	8/30/96 09:55	1375	2.75	13	4.7	0.25	<LOD	<LOD	<LOD
126	20WE	8/29/96 11:35	8/30/96 10:30	1375	2.75	14	5.1	0.27	<LOD	<LOD	<LOD
127	20SJ	8/29/96 10:05	8/30/96 09:15	1390	2.78	29	10	0.55	<LOD	<LOD	<LOD
128	20TQ	8/29/96 10:40	8/30/96 09:30	1370	2.74	51	19	1.0	<LOD	<LOD	<LOD
129	20ARB	8/29/96 08:40	8/30/96 07:40	1380	2.76	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
130	BLANK	8/30/96 07:40	8/30/96 07:40	0	0.00	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD

LOD = 3.3 ng per sample for Endosulfan I and 11 ng per sample for Endosulfan II
Det. = <11 ng (LOQ) but >3.3 ng (LOD) for Endosulfan I
= <36 ng (LOQ) but >11 ng (LOD) for Endosulfan II
*pptv at 25 C and 1 atm
NR = Not Reported

Table 8. Summary of Endosulfan Ambient Results (ng/m3)

Start Date		ARB Endo-I	ARB Endo-II	CC Endo-I	CC Endo-II	SJ Endo-I	SJ Endo-II	TQ Endo-I	TQ Endo-II	WE Endo-I	WE Endo-II
7/29/96		<LOD	<LOD	8.3	<LOD	17	Det.	21	Det.	8.5	<LOD
7/30/96		<LOD	<LOD	29	Det.	16	Det.	20	Det.	23	Det.
7/31/96		<LOD	<LOD	35	Det.	11	Det.	15	Det.	18	Det.
7/31/96	*	<LOD	<LOD	34	Det.	13	Det.	14	Det.	12	<LOD
8/1/96		<LOD	<LOD	10	<LOD	16	Det.	6.9	<LOD	14	<LOD
8/5/96		<LOD	<LOD	27	Det.	4.4	<LOD	41	Det.	NR	NR
8/6/96		<LOD	<LOD	24	Det.	35	Det.	70	Det.	15	<LOD
8/7/96		<LOD	<LOD	23	Det.	130	13	33	Det.	13	<LOD
8/7/96	*	<LOD	<LOD	23	Det.	120	13	35	Det.	15	<LOD
8/8/96		Det.	<LOD	17	Det.	140	26	35	Det.	17	Det.
8/12/96		<LOD	<LOD	18	Det.	13	Det.	8.1	<LOD	8.0	<LOD
8/13/96		Det.	<LOD	20	Det.	19	Det.	17	Det.	10	<LOD
8/14/96		<LOD	<LOD	14	Det.	9.4	<LOD	10	<LOD	5.5	<LOD
8/14/96	*	<LOD	<LOD	14	Det.	9.4	<LOD	8.7	<LOD	5.9	<LOD
8/15/96		<LOD	<LOD	9.0	<LOD	11	<LOD	45	Det.	4.2	<LOD
8/19/96		<LOD	<LOD	9.1	<LOD	Det.	<LOD	5.9	<LOD	4.4	<LOD
8/20/96		<LOD	<LOD	9.0	<LOD	8.8	<LOD	12	<LOD	5.9	<LOD
8/21/96		<LOD	<LOD	7.1	<LOD	10	<LOD	17	Det.	6.0	<LOD
8/21/96	*	<LOD	<LOD	6.0	<LOD	11	<LOD	16	Det.	4.2	<LOD
8/22/96		NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
8/26/96		<LOD	<LOD	Det.	<LOD	Det.	<LOD	Det.	<LOD	Det.	<LOD
8/27/96		<LOD	<LOD	Det.	<LOD	Det.	<LOD	5.6	<LOD	Det.	<LOD
8/28/96		<LOD	<LOD	4.4	<LOD	4.4	<LOD	5.4	<LOD	Det.	<LOD
8/28/96	*	<LOD	<LOD	4.7	<LOD	4.1	<LOD	6.4	<LOD	Det.	<LOD
8/29/96		<LOD	<LOD	4.7	<LOD	10	<LOD	19	<LOD	5.1	<LOD

Maximum		Det.	<LOD	35	Det.	140	26	70	Det.	23	Det.
Mean		0.78	1.9	14	4.8	24	5.4	21	5.2	9.3	3.0
# samples		19	19	19	19	19	19	19	19	18	18
# > LOQ		0	0	17	0	16	2	18	0	15	0
# > LOD		2	0	19	9	19	7	19	10	18	3

Only the higher value of each collocated pair was used to calculate the above statistics.
Det. results were factored in as (LOD+LOQ)/2=2.49 and 8.16 ng/m3 for I and II; assume 2.88 m3 sample volume.
<LOD results were factored in as 1/2xLOD=0.58 and 1.91 ng/m3 for I and II, assume 2.88 m3 sample volume.

LOD = 3.3 ng/sample for Endosulfan I and 11 ng/sample for Endosulfan II
Det. = <11 ng (LOQ) but >3.3 ng (LOD for Endosulfan I
= <36 ng (LOQ) but >11 ng (LOD) for Endosulfan II
NR = Not Reported
* Collocated samples

Table 9. Endosulfan Ambient Collocated Results

Log #	Sample ID	Start Date/Time	End Date/Time	(ng/m3) Endo-I	(ng/m3) Endo-II	Average (ng/m3) Endo-I	Average (ng/m3) Endo-II	RD* Endo-I	RD* Endo-II
19	3ARB	7/31/96 08:30	8/01/96 08:30	<LOD	<LOD				
20	3ARB-D	7/31/96 08:30	8/01/96 08:30	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
45	7ARB	8/07/96 08:40	8/08/96 08:00	<LOD	<LOD				
46	7ARB-D	8/07/96 08:40	8/08/96 08:00	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
71	11ARB	8/14/96 08:30	8/15/96 08:30	<LOD	<LOD				
72	11ARB-D	8/14/96 08:30	8/15/96 08:30	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
97	15ARB	8/21/96 10:20	8/22/96 08:30	<LOD	<LOD				
98	15ARB-D	8/21/96 10:20	8/22/96 08:30	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
123	19ARB	8/28/96 12:30	8/29/96 08:40	<LOD	<LOD				
124	19ARB-D	8/28/96 12:30	8/29/96 08:40	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
11	3CC	7/31/96 10:05	8/01/96 10:00	35	Det.				
12	3CC-D	7/31/96 10:05	8/01/96 10:00	34	Det.	35	Det.	1.0%	Det.
37	7CC	8/07/96 10:45	8/08/96 09:55	23	Det.				
38	7CC-D	8/07/96 10:45	8/08/96 09:55	23	Det.	23	Det.	0.0%	Det.
63	11CC	8/14/96 09:50	8/15/96 09:50	14	Det.				
64	11CC-D	8/14/96 09:50	8/15/96 09:50	14	Det.	14	Det.	2.5%	Det.
89	15CC	8/21/96 10:55	8/22/96 10:20	7.1	<LOD				
90	15CC-D	8/21/96 10:55	8/22/96 10:20	6.0	<LOD	6.6	<LOD	16%	<LOD
115	19CC	8/28/96 10:25	8/29/96 11:00	4.4	<LOD				
116	19CC-D	8/28/96 10:25	8/29/96 11:00	4.7	<LOD	4.6	<LOD	7.4%	<LOD
15	3SJ	7/31/96 09:20	8/01/96 09:15	11	Det.				
16	3SJ-D	7/31/96 09:20	8/01/96 09:15	13	Det.	12	Det.	8.7%	Det.
41	7SJ	8/07/96 10:00	8/08/96 09:15	130	13.3				
42	7SJ-D	8/07/96 10:00	8/08/96 09:15	120	12.9	125	13	8.0%	2.7%
67	11SJ	8/14/96 09:15	8/15/96 09:15	9.4	<LOD				
68	11SJ-D	8/14/96 09:15	8/15/96 09:15	9.4	<LOD	9.4	<LOD	0.0%	<LOD

* RD = Relative Difference = (Diff./Ave.)100

LOD = 3.3 ng per sample for Endosulfan I and 11 ng per sample for Endosulfan II

Det. = <11 ng (LOQ) but >3.3 ng (LOD) for Endosulfan I

= <36 ng (LOQ) but >11 ng (LOD) for Endosulfan II

Table 10. Endosulfan I and II *Ambient Laboratory* Spike Results *Prepared by QMOSB staff.

Sample ID	Date Analyzed	Endosulfan I Mass (ng)	Expected Mass (ng)	Percent Recovery	Endosulfan II Mass (ng)	Expected Mass (ng)	Percent Recovery
QA-EL1	8/30/97	48.0	118	41%	30.00	27.0	111%
QA-EL2	8/30/97	45.0	118	38%	29.00	27.0	107%
QA-EL3	8/30/97	<LOD	0	NA	<LOD	0	NA
QA-EL4	8/30/97	<LOD	8.40	0%	<LOD	0	NA
QA-EL5	8/30/97	<LOD	8.40	0%	<LOD	0	NA
QA-EL6	8/30/97	16.0	42.0	38%	26.00	27.0	96%
QA-EL7	8/30/97	16.0	42.0	38%	28.00	27.0	104%

Table 11. Endosulfan I and II *Ambient Trip* Spike Results *Prepared by QMOSB staff.

Sample ID	Date Analyzed	Endosulfan I Mass (ng)	Expected Mass (ng)	Percent Recovery	Endosulfan II Mass (ng)	Expected Mass (ng)	Percent Recovery
AccuStandard							
QA-ET1	10/4/96	12.0	118	10%	<LOD	27.0	0%
QA-ET2	10/4/96	12.0	118	10%	<LOD	27.0	0%
QA-ET3	10/4/96	<LOD	0	NA	<LOD	0	NA
QA-ET4	10/4/96	<LOD	8.40	0%	<LOD	0	NA
QA-ET5	10/4/96	<LOD	8.40	0%	<LOD	0	NA
Axact							
QA-ET6	10/9/96	27.0	118	23%	20.0	27.0	74%
QA-ET7	10/9/96	27.0	118	23%	19.0	27.0	70%
QA-ET8	10/9/96	<LOD	0	NA	<LOD	0	NA
QA-ET9	10/9/96	<LOD	8.40	0%	<LOD	0	NA
QA-ET10	10/9/96	<LOD	8.40	0%	<LOD	0	NA

Table 12. Endosulfan I and II *Ambient Field* Spike Results *Prepared by QMOSB staff.

Sample ID	Date Analyzed	Endosulfan I Mass (ng)	Expected Mass (ng)	Percent Recovery	Endosulfan II Mass (ng)	Expected Mass (ng)	Percent Recovery
QA-EF1	10/9/96	4.50	8.40	54%	<LOD	0	NA
QA-EF2	10/9/96	3.90	8.40	46%	<LOD	0	NA
QA-EF3	10/9/96	45.0	118	38%	23.0	27.0	85%
QA-EF4	10/9/96	45.0	118	38%	22.0	27.0	81%
QA-EF5	10/9/96	<LOD	0.00	NA	<LOD	0	NA

Table 13. Endosulfan I and II *Application Laboratory* Spike Results

Sample ID	Date Analyzed	Endosulfan I Mass (ng)	Expected Mass (ng)	Percent Recovery	Endosulfan II Mass (ng)	Expected Mass (ng)	Percent Recovery
QA-LS1	4/21/97	44.9	50.0	90%	33.2	50.0	66%
QA-LS2	4/21/97	39.9	50.0	80%	28.8	50.0	58%
QA-LS3	4/21/97	39.8	50.0	80%	30.2	50.0	60%
QA-LS4	4/21/97	40.7	50.0	81%	31.2	50.0	62%

*Prepared by CDFA staff.

Table 14. Endosulfan I and II *Application Trip* Spike Results

Sample ID	Date Analyzed	Endosulfan I Mass (ng)	Expected Mass (ng)	Percent Recovery	Endosulfan II Mass (ng)	Expected Mass (ng)	Percent Recovery
QA-TS1	4/21/97	41.5	50.0	83%	30.0	50.0	60%
QA-TS2	4/21/97	40.2	50.0	80%	28.6	50.0	57%
QA-TS3	4/21/97	43.3	50.0	87%	33.1	50.0	66%
QA-TS4	4/21/97	39.2	50.0	78%	29.5	50.0	59%

*Prepared by CDFA staff.

Table 15. Endosulfan I and II *Application Field* Spike Results

Sample ID	Date Analyzed	Endosulfan I Mass (ng)	Expected Mass (ng)	Percent Recovery	Endosulfan II Mass (ng)	Expected Mass (ng)	Percent Recovery
QA-FS1	4/21/97	42.1	50.0	84%	30.0	50.0	60%
QA-FS2	4/21/97	44.8	50.0	90%	28.6	50.0	57%
QA-FS3	4/21/97	41.9	50.0	84%	33.1	50.0	66%
QA-FS4	4/21/97	40.7	50.0	81%	29.5	50.0	59%

*Prepared by CDFA staff.